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ABSTRACT

A mainline CAI system is an individualized instructional system of major scope which uses the computer as a tool for instructional management and information transmission. Such systems are developed according to a design science approach and used as a less costly alternative to conventional instruction. In contrast, adjunctive systems have a much smaller scope and are used in support of regular classroom or laboratory instruction. TICCIT is classified as a mainline CAI system because (1) it was not designed by a single faculty author for a single course, (2) it is not used on existing computer systems, (3) it does not use existing languages, and (4) it does not employ normative grading. (CMV)

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INSTITUTE FOR COMPUTER USES IN EDUCATION

WHAT IS A "MAINLINE" CAI SYSTEM?

C. Victor Bunderson

Occasional Paper No. 1

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

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WHAT IS A "MAINLINE" CAI SYSTEM?

C. Victor Bunderson
Brigham Young University
February, 1974

What is the definition of "mainline" CAI? The term "mainline" seems obviously to mean that the computer is the primary means of instruction and testing. But this simple statement leaves several questions unanswered. For example, must the computer be the only means of instruction and testing? If the teacher's role in a system turns out to be rather extensive, would that make the system adjunctive? Or if the student is given a handbook, does that make the system less "mainline" than it would be without one? These are questions of definition that are of concern to everyone involved in the TICCIT project as we communicate with one another about the TICCIT system and its role in community college education.

The term "mainline CAI" was first introduced to a wide college audience in June, 1970, at the Conference on Computers in the Undergraduate Curriculum (Bunderson, 1970). At that conference, a distinction was made between two types of computer assisted instruction systems: adjunctive systems and mainline systems. The two types actually represent the extremes of a continuum. The two extremes differ generally in ease and cost of developing the program, system requirements, and economic potential to education.

Adjunctive systems were defined as being used in support of regular classroom or laboratory instruction. The adjunctive system

> . . . is used for illustration of quantitative relationships, simple simulation, quickly generated drill, practice, or testing. Often it is a form of homework. Seldom does it deal with content which has not been introduced in class, but when new content is introduced, it is usually by a discovery approach which places a great deal of instructional burden on the student, rather than by a carefully designed tutorial or expository sequence.
>
> Computer applications within this category are relatively quickly and easily generated by a faculty member. Alternatively, they simply use available computer languages known by the student for problem solving or exploration of his set of examples or problems prepared by the instructor.
>
> Systems requirements for these applications are not strict. Many of them are suitably accomplished with batch processing systems. When interactive systems are used, teletypes or selectric typewriters are usually suitable, except when a simulation or illustration using computer graphics is employed. Languages like APL, BASIC, or standard compiler languages are most often used (Bunderson, 1970).

The second class of computer assisted instruction system is designated as "mainline" because it supplants some or all of the usual teaching staff and classroom or laboratory facilities.

> This class of programs teaches new concepts and information, ideally in a highly effective and efficient manner. Students work at their own pace in an individualized manner. The computer may act as an evaluator, manager, tutor, simulator, and drill-master as well as a tool in problem solving.

> The development of programs of this class is expensive and time consuming. It is most analogous to the development of a good textbook for mass dissemination, but there are additional complications in the development process due to constructional design and computer systems technologies.
>
> System requirements imply a facility with multiple terminals in time sharing load, dividing system response time following each student entry in the order of .5 seconds. Cathode ray tube terminals, rather than teletypes, are highly desirable because of noise and speed considerations.
>
> Applications in this second category have the potential of helping to solve major economic and logistic problems facing higher education, which the adjunct use of the computer, representing an add-on cost, does not have (Bunderson, 1970).

The MITRE Corporation has stated clearly where the TICCIT system stands with regard to this distinction:

> The mainline approach being taken in this program . . . is designed from the first for mass dissemination. A complete instructional system is redesigned for a substantial block of material so that the role of teachers is redefined and eventually reduced (primarily by relieving the teacher of class presentations) as the system becomes more technologically intensive and less labor intensive. Lock-step scheduling is replaced by a self-paced, individualized scheduling system, with a criteria reference standard for grading to replace grading "by the curve." A design and development team, having total capabilities not often possessed by the individual teacher, is responsible for the courseware development, documentation, and packaging for distribution (Stetten, 1972).

ADJUNCT	MAINLINE
--- CONTEXT PROVIDED BY TEACHER.	--- REDESIGN OF A COMPLETE INSTRUCTIONAL SYSTEM, INCLUDING THE TEACHER'S ROLE.
--- PROGRAMMING BY TEACHER AND STUDENT.	--- SPECIFICATIONS AND PROGRAMMING BY DESIGN-PRODUCTION TEAMS.
--- FITS WITH STANDARD CREDIT-HOUR SCHEDULING.	--- REQUIRES SELF-PACED SCHEDULING AND GRADING.

SOME CONSEQUENCES OF EACH APPROACH

--- REPRESENTS AN ADD-ON COST.	--- GREAT ECONOMIC POTENTIAL: SUPPLANTIVE.
--- REQUIRES LOW TO MODERATE CAPITAL INVESTMENT.	--- REQUIRES HIGH CAPITAL INVESTMENT.
--- INCREASED EFFECTIVENESS: OPPORTUNITY FOR RESTRUCTURING OBJECTIVES AND SUBJECT MATTER.	--- INCREASED EFFECTIVENESS AND EFFICIENCY.
--- MODEST BUT VARIABLE SYSTEM REQUIREMENTS: USE SCIENTIFIC OR BUSINESS ORIENTED COMPUTER SYSTEMS.	--- SPECIFIC ENGINEERING DESIGN FOR EDUCATION.

A Distinction Between Two Classes of CAI Programs
(Stetten, 1972)

This material demonstrates that, according to the original distinction between mainline and adjunctive CAI systems, the TICCIT system cannot be considered adjunctive. It was not designed by a single faculty author. It is not used on existing computer systems, but on a new system of special design, it does not use existing languages, and it does not employ normative grading. The entire definition of the distinction between adjunctive and mainline certainly does not hinge on the extent to which faculty members provide the context. None of the TICCIT courses in either mathematics or English require that faculty members provide all of the context. That is, the TICCIT material is designed to be disseminated to other colleges and perhaps to other universities and high schools in the future. This requires extensive documentation of the faculty members' roles by the end of the project, and great structure and support to be provided by the total system of computer programs and materials. While on the English course more faculty support is required and while this support can be extremely creative, it is a well-structured part of the total system designed to achieve educational goals.

The use of a handbook is also seen to be part of a total system. From the beginning of the TICCIT project, the student handbook was seen as one of the essential elements of a mainline system. Since computer displays on any device like a TV display or plasma display leave no record, an early consideration in the design of the TICCIT courseware was the need for a reference handbook - something the student could use for review and preview when away from the computer while he was taking the course and

could use for reference after the course. A computer printout serves some of these purposes in a typewriter-based CAI system, though not very well. A textbook serves these purposes in traditional instruction. A textbook is designed to teach, however, rather than merely for reference. Sometimes it does not serve the reference purpose well. The TICCIT handbook would not be designed to teach, but for orientation and reference. Despite this, some of the better students may be able to learn from it. This only enhances the total system's chances of achieving its design goals of efficiency and reduced time.

Those who funded this project at NSF and who see if from its broadest perspective see the TICCIT project as being a test of an instructional system, not a particular computer hardware and software configuration. By contrast, they see the PLATO project as a test of a new instructional tool. While TICCIT may prove to be as versatile and useful a tool as PLATO in the long run, the evaluation of TICCIT will rest on the total systems aspects, and not on the contribution of the computer alone.

The term "mainline instruction" was necessary in 1970 to draw the attention of decision makers to the advantages of a total instructional system approach. The field of computer-assisted instruction at that time had little differentiation in the minds of many between the various uses of computers in education. The introduction of the term served that purpose. It can be confusing to us now. In fact, in 1971 I made some effort to back away from the term "mainline". Unfortunately, this term seems to have embedded itself

firmly in the vernacular, so we can only hope to define it more accurately in our communication.

In a paper presented at the Spring Joint Computer Conference, the following definition was offered:

> It serves as a shorthand term for individualized instructional systems of major scope, using the computer as a tool for instructional management and information transmission, developed according to a design science approach and used as a less costly alternative to conventional instruction (Bunderson, 1972).

This definition captures the spirit of what we see the TICCIT system being today.

This article also suggests that through the widespread dissemination of cost-effective computer equipment, faculty members and students will have access to low-cost computer resources so that they can engage in those useful and interesting interactions which have come to be identified under the term "adjunctive". In TICCIT we would hope that faculty members could program their own materials on the extra options menus of the TICCIT lessons as they invented clever computer-mediated approaches to these lessons. They may also wish to develop adjunctive lessons, simulations, games and other materials in units registered under other titles and with other labeling systems than are found in the TICCIT courseware produced by BYU.

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